JPRS 83785

29 June 1983

China Report

SCIENCE AND TECHNOLOGY

No. 201

FBIS FOREIGN BROADCAST INFORMATION SERVICE

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

PROCUREMENT OF PUBLICATIONS

JPRS publications may be ordered from the National Technical Information Service, Springfield, Virginia 22161. In ordering, it is recommended that the JPRS number, title, date and author, if applicable, of publication be cited.

Current JPRS publications are announced in Government Reports Announcements issued semi-monthly by the National Technical Information Service, and are listed in the Monthly Catalog of U.S. Government Publications issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Correspondence pertaining to matters other than procurement may be addressed to Joint Publications Research Service, 1000 North Glebe Road, Arlington, Virginia 22201.

JPRS 83785

29 June 1983

CHINA REPORT

SCIENCE AND TECHNOLOGY

No. 201

CONTENTS

PEOPLE'S REPUBLIC OF CHINA

ABSTRACTS

RESTRUCTURING OF ENGINEERING EDUCATION URGED

Beijing REMIN RIBAO in Chinese 27 Mar 83 p 3

[Article by Zhang Guangdou [1728 0342 2435]: "The Structure of Engineering Education Needs Reform"]

[Text] Summary: There must be a suitable proportionality among the various types of training of engineering and technical personnel in graduate and undergraduate college courses, advanced and intermediate specialized schools and the like. There should be a suitable proportionality between the various levels in the engineering education structure. Currently, our engineering education structure is out of proportion, with an excessively large proportion of universities, and an excessively small proportion of advanced specialized, and particularly intermediate specialized, schools, and technical schools; the structure of engineering education must be adjusted in accordance with China's specific conditions.

Premier Zhao Ziyang has said, "Scientific and technical work should be oriented toward economic construction." I believe that engineering education in particular should be oriented toward economic construction and should train able engineering scientists and technicians and produce engineering results.

For engineering education to be oreinted toward economic construction, we must train capable engineering scientists and technicians in a planned fashion and meet the demands of economic construction in terms of quantity and quality. Economic construction require's wide variety of trained engineering personnel, so engineering education should be multileveled, including college graduate and undergraduate programs, advanced and intermediate specialized schools, technical schools and the like; each level may have several types and varieties of training.

All levels of enginerring education must have their own training objectives, teaching plans, teaching materials and teaching methods. The specialities should be rather broad and the range of knowledge taught rather wide, with a focus on training abilities and creativity. This will help develop engineering education, and after the students graduate it will be easy for them to adapt to work. We must assure good teaching quality and must not pursue numbers at the expense of quality.

We have no good forecasts of our requirements for engineering personnel, and the levels of the engineering education structure are out of proportion. As a result, we must first carry out thorough surveys based on economic construction plans, clarify personnel requirements and the conditions under which personnel will be used, and make long-term and short-term forecasts of the personnel needs of each level, specialty and type of training.

Everyone says that China has too few engineering personnel, but no one makes it clear just how many we need. Some people say that foreign countries have such-and-such a number of engineering college graduates per 10,000 population and we have such-and-such a number, which is too few. This is not a broad enough view, because countries differ in scale of economic construction and stage of development, their social conditions differ, and the need for engineering technical personnel depends on the number and size of industrial enterprises and is not directly proportional to populations. Currently, about 95,000 students enter Chinese engineering colleges each year, while engineering colleges graduate 65,000 persons a year in the United States, 10,000 a year in the France, and 20,000 a year in West Germany. Thus every year China's industrial colleges admit a rather considerable number of students.

Economic construction requires a specific proportionality between the numbers of engineering personnel graduated at the various levels. The experience of industrially developed countries is that the proportion should be as follows: one college graduate, one advanced school graduate, 3 or 4 intermediate specialized school graduates, and more than 10 technical school graduates. Their industrial enterprises have very few ordinary workers. Foreign experience can be used only for reference, but it is indisputable that economic construction requires relatively small number of college graduates, a relatively large number of advanced and intermediate specialized school graduates, and an even greater proportion of technical school graduates.

In China, plans call for admission of intermediate and advanced school students and intermediate specialized school students in the proportion of 1:1.27 changing to 1:1.25 in 1985. There is also a tendence to increase the number of advanced-school nonresident students and branch schools; if these are included in the figures, the proportion is reversed. This is clearly irrational. Economic construction includes a large amount of ordinary engineering and technical work which can be done by graduates of intermediate specialized schools, and does not require engineering college graduates. Engineering college graduates should be used primarily for development, creation and innovation, thus driving scientific and technical progress. If there are too few graduates of intermediate specialized schools, many college graduates will have to do work that they could have done, which is a very uneconomical approach to education; since education funds are very limited, we must not do this. If we take this approach we will need a very large number of engineering college graduates, which will be hard for us to achieve in terms of labor, financial and material, resources. Because they will not have any use for most of the courses they study in college, it will be difficult to raise the quality of college teaching. More importantly, if college graduates are not engaged

in creative, pioneering renovation work, this may harm scientific and technial progress and economic construction.

Recently the relevant departments made a survey of some industrial enterprises in Shanghai and Beijing and discovered that the proportion between the number of engineers and technical personnel generally was 5:1 or more, reaching a maximum of 9:1, which was just the reverse of what it should have been, so that many engineers were doing the work of technical personnel. Advanced schools and research units have many instructures and research personnel, but only very few experimental technicians and assistants, so that many teachers and research personnel are doing the work of laboratory technicians and assistants. We should further clarify the fact that if the personnel structure is inverted it is impossible to organize efficient working groups, so that production, scientific research and teaching will not develop properly, which may hinder theprogress of science and technology. Conditions in existing industrial enterprises, cientific research units and advanced schools prove this point.

To summarize, the various types of engineering scientists and technicians should be in a suitable proportion if work is to develop smoothly and if science and technology are to develop rapidly. Therefore there should be a suitable proportionality between the various levels of education, which should be established in terms of China's actual conditions. Currently our engineering education sturcture is seriously out of balance, colleges have too large a share and advanced specialized schools and especially intermediate specialized schools and technical schools, have too small a share; we must energetically redress the situation. Engineering colleges should focus on improving teaching quality and develop steadily. The number of advanced schools should be increased, and there should be an especially large increase in the number of intermediate specialized and technical schools. Some of the ordinary advanced and intermediate schools should be turned into intermediate specialized schools, technical schools and vocational schools. This is a major reform of rengineering education which requires a concerted effort by the education, industrial, labor and planning departments if it is to succeed. It also involves such problems as qualified teachers, housing, instrumentation and equipment, and operating funds and entails main many difficulties. But in order to proceed with economic construction, under the leadership of the party Central Committee, we must reform our engineering education structure and do so effecitvely.

8480
CSO: 4008/78

NATIONAL DEVELOPMENTS

HEBEI PEASANTS START TECHNICAL TRAINING CLASSES

OW241359 Beijing XINHUA in English 1140 GMT 24 May 83

[Text] Shijiazhuang, 22 Apr (XINHUA)--Advertisements posted on a cement pole next to the 1400-year-old Zhaozhou Bridge in Zhaoxian County, Hebei Province, offer training courses by peasants for tailoring and repairing watches, clocks and television sets.

Technical schools run by individual peasants are mushrooming in China. The development is one that meets the needs of specialized and socialized production emerging in the country's rural areas as a result of the government's support of independent entrepreneurship. Hebei Province now has more than 20 such schools in Zhaoxian, Xishui, Jiangxian, Neiqiu and Zhengding Counties that serve crop cultivation, animal breeding, processing and service trades in the countryside.

Wang Lianqin, 45, a technician in Quxizhang production brigade, Wangxizhang Commune of Zhaoxian County, is one of those who put up the advertisements. He has trained 95 people from five provinces in repairing watches, clocks, radio and television sets by running eight training classes since December 1980. Some of his students have been running technical training classes of their own.

Zhang Yingmei, 36, a successful chicken breeder in Neiqiu County, has run two egg-hatching classes and trained 53 peasants since last December. The school in her house in Wnagjiatun production brigade teaches the trainees to hatch eggs by four methods: with warm water, in a heated kang (earthen bed), in electric incubators or in a hothouse in accordance with a contract they signed with her. She now has a third class with 30 peasants attending and nearly a thousand more peasants from nearby counties have applied to attend or for teaching materials.

A senior middle school graduate, Zhang Yingmei learned about her new job through reading. In the past two years she subscribed to 28 newspapers and magazines and bought more than 250 books including such university texts as "animal science," "poultry science" and "early embryology of the chick" by B. M. Patten. Now the hatchery she built can hatch 25,000 eggs every three months.

In 1982, she had a net income of 7,900 yuan from raising 260 hens and hatching eggs, or 10 times the income she received in 1979 when she started.

After her success, she decided to help other peasants to earn more by starting a training school.

"I want to help my fellow peasants to get rich, not by giving them money or goods but by passing on my knowledge," Zhang Yingmei said.

CSO: 4010/72

EXPERIMENTAL STUDY OF NUCLEAR REACTOR MODEL FUEL ASSEMBLY

Beijing HE KEXUE YU GONGCHENG [CHINESE JOURNAL OF NUCLEAR SCIENCE AND ENGINEERING] in Chinese Vol 2 No 3, Sep 82 pp 193-202

[Article by Han Liangbi [7281 5328 1732], Shi Guolin [2457 0948 7792], Wang Yufen [3769 3768 5358], Yao Weida [1202 0251 6671], Xu Dinggeng [1776 1353 5105] of the 728 Research and Design Institute and Cheng Shuxia [4453 2562 7209] and He Yuzhi [0149 3768 2655] of the Shanghai Institute of Nuclear Research of the Chinese Academy of Sciences: "Experimental Study of Flow-induced Vibration of a Model Fuel Assembly." This article was received on 18 September 1981.]

[Text] [Abstract]

Except for the use of a simulated specific gravity core as the fuel rod in the model fuel assembly, its structure, materials, dimensions are all the same as the real thing. The supporting conditions inside the reactor pile were simulated. Flow-induced vibration tests used a bypass of a closed cold water loop for flow resistance tests. The resistance strain plate was used to pick up the vibration which was then analyzed by the dynamic strain meter and the dynamic frequency spectra analyzer. The density curve of the power spectrum of the strain on the fuel rod in the model fuel assembly under different flow velocities and the mean square root value of the strain were obtained. The relation obtained by using the ratio between the basic frequency strain and the amplitude and then by converting it to the mean square root value of amplitude is that the amplitude is directly proportional to the 1.63d power of the flow velocity when the Reynolds number is less than 1.43×10^5. This article also discusses the dynamic innate characteristics of the fuel assembly, the fuel rods and the guiding pipe, and preliminarily explores the effect of added mass of water.

I. Introduction

Flow-induced vibration tests of the fuel assembly are an important research topic in nuclear reactor engineering. This is because the vibration of the

fuel rods will cause dynamic local changes in the course of flow of the coolant and it also affects the life of the fuel rods. A lot of work has already been done to study this aspect in our nation and abroad [1-7], but most of the work emphasizes the study of flow-induced vibration of single span fuel rods. Also, because of the difference in the type of reactor, the structural arrangement and the operating condition, experimental data cannot be extrapolated. Therefore, when designing a new reactor, we must conduct corresponding flow-induced vibration tests of the fuel assembly. The purpose of our experiment was to directly measure on an experimental circuit the original frequency and amplitude of the multiple-span submerged fuel rods (abbreviated fuel rods) of a certain pressurized water reactor's model fuel assembly (abbreviated assembly).

To understand the many factors affecting the flow-induced vibration of the assembly, we conducted flow-induced vibration tests and we also did the following preliminary work: (1) we tested the stationary rigidity of the assembly; (2) we tested the free vibration of the assembly, the fuel rods and the guiding tube; (3) we tested the effect of added mass of water on the fuel rods in stationary water.

II. Test of the Inherent Stationary and Dynamic Characteristics of the Assembly

2.1 Stationary Rigidity Test of the Assembly

The assembly consists of fuel rods, top and bottom pipe bases, guiding pipes, flow measuring pipe, positioning grid and tightening springs. To determine the bending rigidity of the assembly and calculate the basic frequency, we conducted a stationary bending rigidity test for the assembly. The experimental supports, the arrangement of the test points and the loading situation are illustrated in Figure 1. The top part of the support illustrated in the figure simulates the function of the upper plate in the active zone. The assembly was loaded and the deflection of each test point was measured and read. We used the deflection of the criss-cross bent beam of equal section and converted them to the stationary bending rigidity of the assembly. Table 1 lists the converted stationary bending rigidities of the sections measured. The average value is $2.26 \times 10^6 kg\text{-}cm^2$.

The x, y and EI in Table 1 are the coordinates of the measured section, the deflection and the stationary bending rigidity of the assembly.

Table 1. Stationary Bending Rigidity of the Assembly

Test points	1	2	3	4	5	6	Average value
X (cm)	57	102	147	237	286	282	
Y (cm)	0.0112	0.0226	0.0325	0.0327	0.0268	0.012	
EI ($10^6 kg\text{-}cm^2$)	2.73	2.25	1.96	1.95	2.01	2.68	2.26

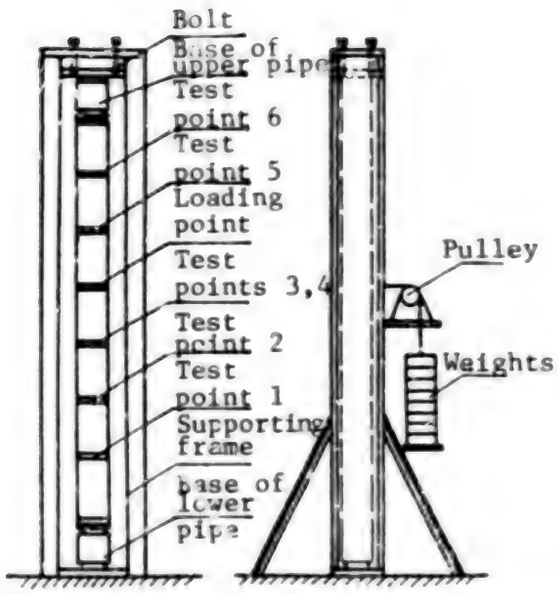


Figure 1. Supporting Frame for the Stationary Bending Rigidity Test

2.2 Free Vibration of the Assembly, Fuel Rods and Guiding Pipes

To analyze the test data of flow-induced vibration of the assembly, we measured the original frequencies of the fuel rods, the guiding pipes and the original basic frequency of the assembly in air before conducting the loop experiment.

1. Test of the original basic frequency of the assembly. We placed the assembly on a supporting frame to test its stationary bending rigidity as shown in Figure 1. We then used a hammer to cause the assembly to produce free vibration. The original basic frequency of the assembly measured in air was 5.5 Hz, the measured impedance ratio ζ was 0.4 percent.

The calculated value [9] of the original basic frequency of the assembly in air converted from the stationary bending rigidity was 5.47 Hz. The calculated length of the assembly was $L = 336.7$ cm; the rigidity of the assembly was $EI = 2.26 \times 10^{9}$ kg-cm^2; the mass of unit length of the assembly was $M = 1.38 \times 10^{-3}$ kg-s^2/cm^2; and the stationary axial force was $S = 956$ kg.

2. The measurement of the original frequencies of the fuel rods and the guiding tubes. We attached zirconium-titanium-lead porcelain piezoelectric crystalline chips (abbreviated crystaline chips) on the fuel rods and guiding pipes to induce and pick up the vibrations. The resonance method was used to measure the original frequencies of the fuel rods and the guiding pipes at each level. The testing system is illustrated in Figure 2.

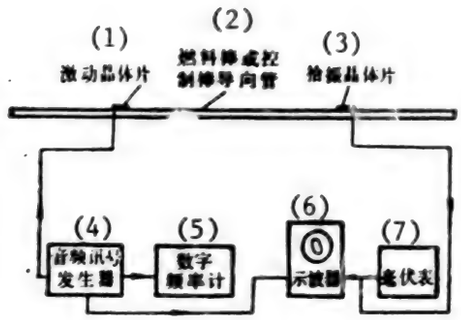


Figure 2. The System for Testing the Original Frequencies of the Fuel Rods and the Guiding Pipes

Key:
(1) Stimulated crystalline chip
(2) Guiding pipes for fuel rods or control rods
(3) Vibration pick-up crystalline chips
(4) Sound frequency signal generator
(5) Digital frequency meter
(6) Oscilloscope
(7) Millivoltmeter

The primary data of the fuel rods and the guiding pipes are shown in Table 2. The measured values of the original frequencies of the fuel rods and the guiding pipes of the assembly in air and the corresponding values calculated according to reference [10] are listed in Table 3.

Table 2. Primary Data on the Fuel Rods and the Guiding Pipes

(1) 部件	(4) 跨数 n	(5) 轴向力 S (kg)	(6) 单位长度质量 m_i (kg−s²/cm²)	(7) 外径 D_1 (cm)	(8) 内径 D_1 (cm)	(9) 跨长 L_i (cm)	(10) 拉压弹性系数 α_i	(11) 扭转弹性系数 β_i
(2) 燃料棒	7	0	$m_1=3.06\times10^{-6}$ $m_2-m_1=7.11\times10^{-6}$	1.00	0.86	$L_1=40$ $L_2=L_6=45$ $L_7=49$	$\alpha_1=\alpha_6=3.32\times10^5$	10^4
(3) 导向管	7	0	1.57×10^{-6}	1.29	1.19	$L_1=40$ $L_2=L_6=45$ $L_7=49$	$\alpha_1=\alpha_6=5.14\times10^5$	(12) 大值

Key:
(1) Parts
(2) Fuel rods
(3) Guiding pipes
(4) Number of spans
(5) Axial force
(6) Mass of unit length
(7) Exterior diameter
(8) Interior diameter
(9) Length of span
(10) Coefficient of elasticity of pulling pressure
(11) Coefficient of elasticity of twisting
(12) Large value

Table 3. Original Frequencies (Hz) of the Fuel Rods and Guiding Pipes

Number of steps of vibrations	Fuel rods		Guiding pipes	
	Experimental	Computed	Experimental	Computed
1	59.5	60.3	372	322.1
2	64.3	65.3	379	375.4
3	68.4	71.7	384	377.2
4	78.1	80.0	388	379.5
5	92.8	89.1	395	381.9
6	98.4	96.7	406	383.7
7	130.7	144.3	409	482.9
8	185.1	184.1	1006	888.0
9		205.3	1031	1035.4
10	218.8	218.9	1048	1040.1
11	246.8	235.9	1057	1046.5
12		253.2	1068	1052.9
13		267.3	1111	1057.6
14		382.0	1121	1331.3

2.3 Test of the Effect of Added Mass on the Fuel Rods in Stationary Water

The added mass of water on the fuel rods vibrating in water affects the amplitude and the frequency of the fuel rods. Therefore we conducted tests of added mass on the beam free at both ends and on the single span small assembly in stationary water. To bring out the function of the added mass of water, we used empty zirconium pipes for the beam free at both ends and the small assembly without loading the core. The beam free at both ends was 42 cm long. The distance of span of the single span small assembly was 38 cm. The positioning grid, the guiding pipe, the flow measuring pipe and the arrangement of the grids were all the same as the corresponding ones in the assembly. Empty zirconium pipes like the casing pipes of the fuel rods were inserted into the grids. Both ends were sealed by waterproof agents. The resonance method was used to separately measure the original frequencies of the empty zirconium pipes in air and in water, then the added mass of the water [5] was calculated by conversion. The results of conversion by calculation are listed in Table 4. The ratio of mass calculated according to the formula for the added mass of stationary water of infinite medium was 58.8 percent.

It can be seen from Table 4 that the experimental values of the ratios of mass approached the calculated values, but the influence of the confining conditions

Table 4. Effect of Added Mass on the Fuel Rods in Stationary Water

(1) 端部条件	(4) 振型 1			(9) 振型 2			(14) 振型 3		
	(5) 频率 (H_z)		质量比 $\frac{m}{m_0}$	(10) 频率 (H_z)		质量比 $\frac{m}{m_0}$	(15) 频率 (H_z)		质量比 $\frac{m}{m_0}$
	(6) 空气中	(7) 水中	(8)	(11) 空气中	(12) 水中	(13)	(16) 空气中	(17) 水中	(18)
(2) 自由端	252	207	56%	679	554	52%	1326	1079	52%
(3) 弹性支承栅格架	277	217	63%	785	624	58%	1509	1209	56%

Key:
(1) End condition
(2) Free end
(3) Flexible support, spring grid support
(4) Vibration type 1
(5) Frequency
(6) In air
(7) In water
(8) Mass ratio
(9) Vibration type 2
(10) Frequency
(11) In air
(12) In water
(13) Mass ratio
(14) Vibration type 3
(15) Frequency
(16) In air
(17) In water
(18) Mass ratio

of the support was not visible. In tests of flow-induced vibrations of the assembly, the calculated ratios of mass of the fuel rods was 12.2 percent, and the calculated value of the frequency ratio of $f_{\text{in water}}/f_{\text{in air}}$ was 94.4 percent. Therefore, it is expected that in the test data of flow-induced vibrations of the assembly, the effect of added mass of water upon the original frequency of the fuel rods in water is not visible.

III. Tests of Flow-Induced Vibrations of the Assembly

To reduce the amount of equipment for the loop and to reduce cost, the test section of flow-induced vibration of the assembly was installed on the bypass loop for the flow-induced resistance test. This loop was a closed loop of deionized water. The temperature of the test water was between 28° and 40°C. The maximum volume of flow during no-load operation of the main pump of the loop was 900 cubic meters/hour. The test loop and the test section are shown in Figures 3, 4. To avoid the influence of vibration of the main pump, the pipes and the valves upon the test results, the ground foundation of the large hall of the test loop and that of the main pump were separated. Five fortifying rings were affixed on the test section. The measured amplitude of the test section during no-load operation was below 0.12 mm. The structure of the test section is shown in Figure 4.

Before introducing the flow-induced vibration of the assembly, the resistance strain chips with a base of normal temperature paper with small graduations were attached to the fuel rods (abbreviated strain chips). They were made waterproof and were used to pick up vibrations. The waterproof properties and

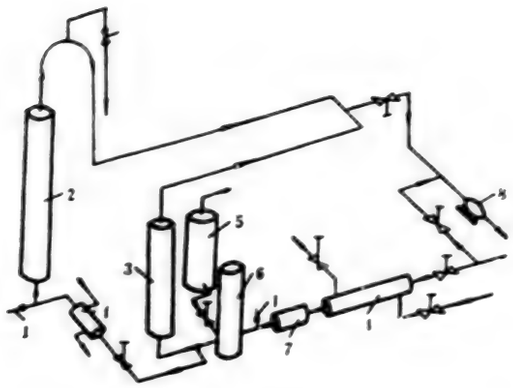


Figure 3. Vibration Test Circuit of Resistance of Assembly

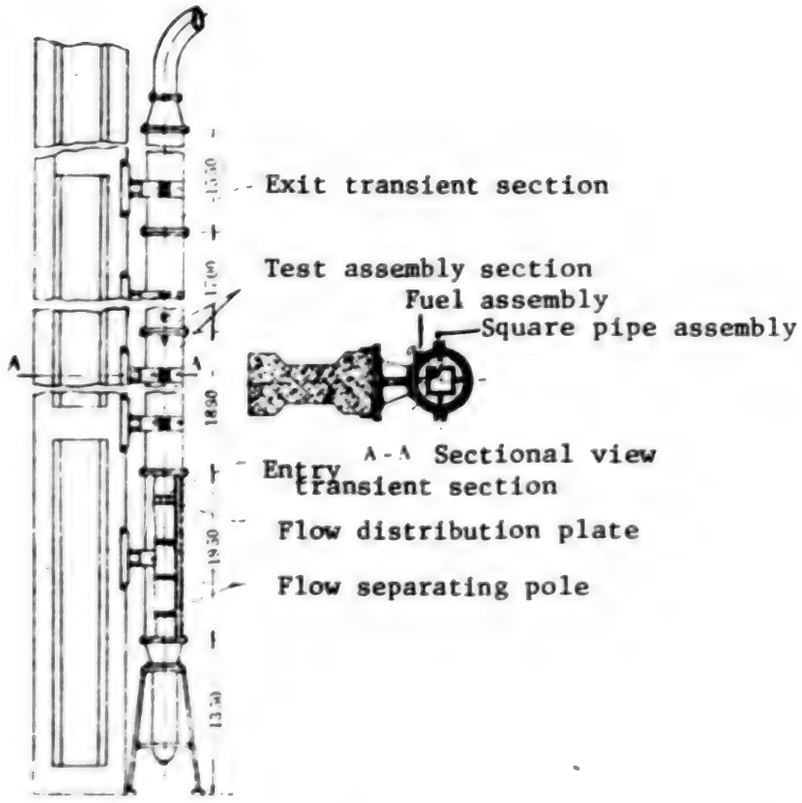


Figure 4. Sectional Structure of Flow-Induced Vibration Test of Assembly

adhesion properties of the strain chips passed the test of flow velocities in high speed water tunnel tests. According to the symmetry of the arrangement of the section of the assembly, the test points of strain chips on the fuel rods were arranged along the diagonal. On the same fuel rod, the test points of the strain chips were placed at the center of the section of the fourth span and the seventh span where the amplitudes were the greater according to calculations of low frequency vibrations of fuel rods. We considered the randomness of the load. Four strain chips were placed at 90° on every section to be measured, as illustrated in Figure 5.

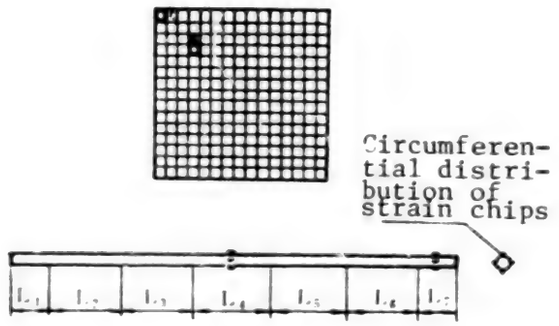


Figure 5. Distribution of the Test Points of Strain Chips

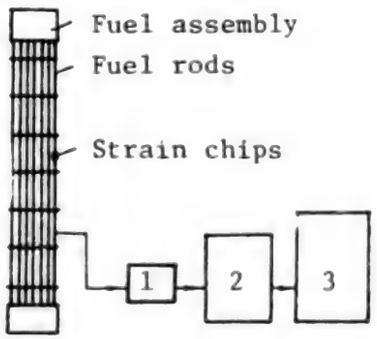


Figure 6. Testing System for Flow-Induced Vibration of Assembly

Key:
(1) Bridge box (2) Dynamic strain meter (3) Dynamic frequency meter

The testing system for flow-induced vibration of the assembly is illustrated in Figure 6. The strain chips on both ends of the diameter of the same section to be measured are connected to the bridge box by the half bridge method. When testing, the two strain chips mutually compensate for the temperature effect and amplify the measuring signals by onefold. When the fuel rods undergo flow-induced vibrations, the signal passes through the strain meter and is recorded. A digital display is shown on the dynamic frequency spectrum analyzer

(abbreviated the dynamic frequency analyzer). To provide a selectible range for engineering purposes, we used five experimental flow velocities of 3.43, 4.73, 5.68, 6.61 and 7.57 m/s. With the measured values read by the dynamic frequency analyzer, we can calculate the mean square root value of strain within a narrow frequency band of one central frequency, the density curve of the power spectrum of the strain in the experiment, and the mean square root value of the strain.

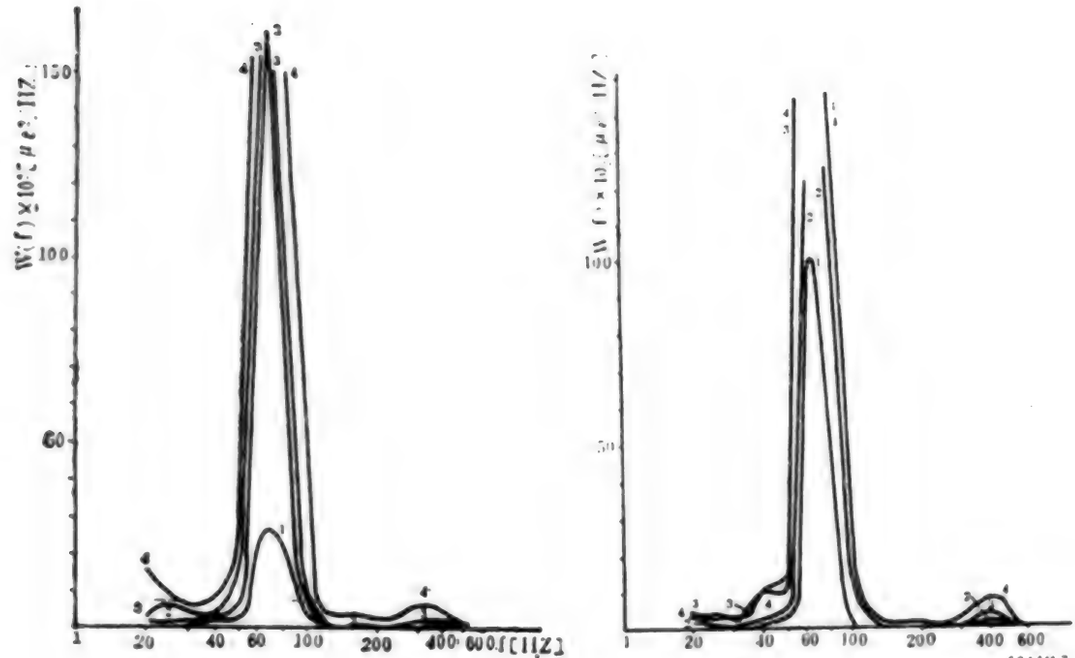
The mathematical relations are:

$$\begin{aligned} \epsilon(f_i) &= \epsilon_0 10^{\frac{d.b}{20}} \\ W(f_i) &= \frac{\epsilon^2(f_i)}{\Delta f_i} \\ \epsilon^2 &= \sum W(f_i)\Delta f_i = \sum \epsilon^2(f_i) \end{aligned} \tag{1}$$

where d.b. is the decibel measured and read by the dynamic frequency analyzer; $\epsilon(f_i)$ is the mean square root value of the strain of the central frequency f_i with a bandwidth of Δf_i; ϵ_0 is the calibrated value of zero decibel corresponding to the vibrator of the dynamic strain meter and the light ray oscilloscope; $w(f_i)$ is the density of the spectrum of the power of the strain in the experiment with central frequency f_i; ϵ^{-2} is the mean square value of strain within the range of the measured and read frequency. According to the number of decibels of the dynamic frequency analyzer, we can use equation (1) to measure the mean square root value of the strain at each test point under different flow velocities and the density curve of the power spectrum of the experimental strain as shown in Figure 7 and Table 5. The huge peak of the density of the power spectrum of the experimental strain is at about 60 Hz.

Table 5. Mean Square Root Values of the Strain and Amplitude Converted From the Number of Decibels Measured by the Dynamic Frequency Analyzer

Flow velocity (m/s)			3.43	4.73	5.68	6.61	7.57
Test points	C_{1-4}	$\epsilon(\mu\varepsilon)$	2.04	3.37	4.38	5.31	
		$\bar{Y}(10^{-3}\text{mm})$	7.21	11.94	15.50	18.79	
	B_{5-8}	$\epsilon(\mu\varepsilon)$	2.92	4.14	5.26	9.01	11.87
		$\bar{Y}(10^{-3}\text{mm})$	10.97	15.56	19.76	33.86	44.61



Test point C_{1-3} Test point C_{2-4}

Figure 7. Density Curve of the Power Spectrum of Strain

To establish the conversion relation for strain and amplitude when the pulsating pressure is an ideal blank noise, we can obtain:

$$\left.\begin{aligned} \bar{Y}^2 &= \sum_{N=1}^{\infty} \frac{\pi S_{pN}}{2\zeta_N \omega^3_{WN}} Y^2_N \\ \bar{\bar{Y}}^2 &= \sum_{N=1}^{\infty} \frac{\pi S_{pN}}{2\zeta_N \omega^3_{WN}} \ddot{Y}^2_N \end{aligned}\right\} \tag{2}$$

where $\bar{Y}$ and $\bar{\bar{Y}}$ are respectively the amplitude and the mean square root value of the second order derivative of the coordinates, and

$$\left.\begin{aligned} S_{pN} &= \lim_{\Delta f \to 0} \lim_{T \to \infty} \frac{1}{\Delta f T} \int_0^T Q^2_{N,\Delta f}(t)\, dt \\ Q_N(t) &= \frac{\sum_1^n \int_0^{L_i} q(x,t) Y_{Ni}\, dx_i}{\sum_1^n (m_i + m_{wi}) \int_0^{L_i} Y^2_{Ni}\, dx_i} \\ 2\zeta_N \omega_{WN} &= \frac{c \sum_1^n \int_0^{L_i} Y^2_{Ni}\, dx_i}{\sum_1^n (m_i + m_{wi}) \int_0^{L_i} Y^2_{Ni}\, dx_i} \end{aligned}\right\} \tag{3}$$

where "i" indicates the ith spanning beam section, N represents the order of the type of vibration, W represents water, c is the viscous damping coefficient, ζ represents the damping ratio, ω represents the circular frequency, q represents the pulsating pressure of water. n represents the number of spans of the continuous beams of the flexible supports. If we do not include the difference between high and low frequency damping ratios, and take into consideration the fact that the low frequencies constitute the dominant factors in the problem of flow-induced vibration of the fuel rods, we can approximately regard the ratio in (2) as the ratio corresponding to the basic frequency, i.e.,

$$Y/\ddot{Y} \approx \ddot{Y}_1(x_i)/\ddot{Y}_1(x_i)$$

Also, from the geometric relationship, we have

$$\varepsilon \approx \ddot{Y} \cdot \frac{D_2}{2}$$

After reorganizing the terms, we can establish the relationship between the mean square root value of the strain of the experiment and the mean square root of the amplitude:

$$Y_i(x_i)\Big|_{\text{experimental value}} \approx \frac{Y_1(x_i)}{\ddot{Y}_1(x_i)} \cdot \frac{2\bar{\varepsilon}_{\text{experimental value}}}{D_2} \tag{4}$$

We can see from Table 6 that using $\ddot{Y}_i/\ddot{Y}_i \approx Y_{1,i}(x_i)/\ddot{Y}_{1,i}(x_i)$ to calculate the mean square root value of amplitude is safer. In Table 6, $Y_{N,i}(x_i)/\ddot{Y}_{N,i}(x_i)$ was calculated by the method described in reference [10]. The mean square root value of the amplitude in Table 5 was calculated from the value of $\bar{\varepsilon}$ in Table 5 and the $Y_{1,i}(x_i)/\ddot{Y}_{1,i}(x_i)$ in Table 6.

In addition, to obtain the relationship between amplitude and flow velocity, we assume that the relationship between the square root value Y of each test point of the fuel rod and the average flow velocity u is exponential, i.e.

$$\bar{Y} = K(x)\, v^b \tag{5}$$

Let $\xi = \lg v,\ \eta = \lg \bar{Y},\ a = \lg K(x)$

i.e. $$\eta = b\xi + a \tag{6}$$

The coefficient b in equation (5) can be determined by the analytical method of linear regression [11] and its coefficient of correlation is:

$$\gamma_{\xi\eta} = \frac{\sigma_{\xi\eta}}{\sqrt{\sigma_{\xi\xi}\,\sigma_{\eta\eta}}} \tag{7}$$

Table 6. The Calculated Value of $\frac{Y_i(X_i)}{\bar{Y}_i(X_i)}$ of Fuel Rods Under Different Types of Vibrations

Type of vibration (N)	Frequency (Hz)		Center of fourth span	Center of seventh span
	In water	In air		
1	59.6	60.3	177.0	187.9
2	61.6	65.3	168.6	177.2
3	67.7	71.7	158.3	164.2
4	75.5	80.0	145.5	148.3
5	84.1	89.1	132.8	133.5
6	91.3	96.7	122.9	122.5
7	136.2	144.3	84.7	64.4
8	174.4	184.7	58.1	54.9
9	193.8	205.3	50.8	48.4
10	206.6	218.9	46.8	44.7
11	222.7	235.9	42.5	40.7
12	239.6	253.2	38.9	37.4
13	252.3	267.3	36.4	35.0
14	360.6	382.0	23.9	23.6

where:

$$\sigma_{\xi\xi} = \sum_{i=1}^{s} (\xi_i - \bar{\xi})^2,$$

$$\sigma_{\eta\eta} = \sum_{i=1}^{s} (\eta_i - \bar{\eta})^2,$$

$$\sigma_{\xi\eta} = \sum_{i=1}^{s} (\xi_i - \bar{\xi})(\eta_i - \bar{\eta})$$

The regression coefficients measured at different test points b_j are not all the same. Take their average value

$$b = \frac{1}{S} \sum_{i=1}^{s} b_i$$

The calculated results are listed in Table 7.

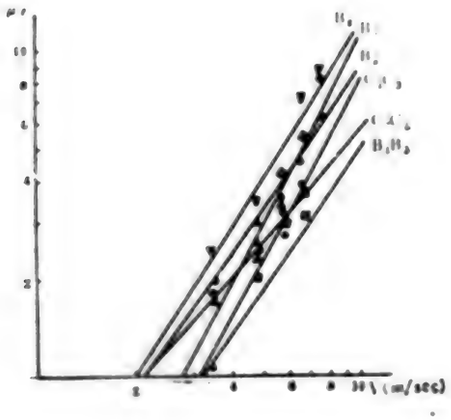


Figure 8. Relationship Between Strain and Velocity of Flow

$\bar{b}$ is 1.63 i.e., when the Reynolds number is within 1.43×10^5, the mean square root value of the amplitude at each test point of the fuel rod is directly proportional to the 1.63d power of the flow velocity. In references [1-3, 5,6], the value of $\bar{b}$ is between 1.5 and 3.0.

Table 7. Values Calculated by Linear Regression Analysis of the Experimental Data

Test points	$\sigma_{\xi\xi}$	$\sigma_{\xi\eta}$	$\sigma_{\eta\eta}$	b_j	$\bar{b}$	$K(x)$	$\gamma_{\xi\eta}$
$C_{1,4}$	0.04510	0.06621	0.09739	1.468	1.63	0.9227	0.999
$B_{3,4}$	0.07187	0.1286	0.2453	1.790		1.403	0.969

IV. Conclusion

Analysis of the experimental data can be summarized by the following points:

1. The original basic frequencies of the assembly, fuel rods and guiding pipes are of three different magnitudes, and in the course of the experiment, we did not discover coupling between the vibration of the assembly and the guiding pipe and the flow-induced vibration of the fuel rod.

2. The velocity of flow of water and the added mass of water did not visibly affect the original frequency of the fuel rods in water.

3. The original low frequencies of the fuel rods in the water still remained dominant. When the Reynolds number is less than 1.43×10^5, the amplitude is directly proportional to the 1.63d power of the flow velocity.

4. Because the amplitude of flow-induced vibration of the fuel rods in water is small, the effect of flow-induced vibration upon the life of the fuel rods is insignificant.

5. We observed in the course of testing that numerical display of the values of the strain by the dynamic frequency analyzer was stable in the course of measuring and reading. This shows that flow-induced vibration of the assembly is a random process that each state goes through.

The questions requiring further consideration are:

1. We should consider the temperature of the coolant to study the situation with a Reynolds number greater than 1.43×10^5.

2. The random pressure pulses on the surface of the assembly, fuel rods and guiding pipes should be measured, and we should conduct theoretical analysis of corresponding randomly induced vibrations.

3. We should study the amplitude of flow-induced vibration of the assembly and guiding pipes and its corresponding original frequency in the water to provide systematic data of flow-induced vibration in designing the fuel assembly.

REFERENCES

1. D. Burgreen, J.J. Byrnes and D.M. Benforado, "Vibration of Rods by Water in Parallel Flow," Trans. ASME Vol 80, No 5, July, 991-1003 (1958).

2. R.T. Pavlica and R.C. Marshall, "An Experimental Study of Fuel Assembly Vibration Induced by Coolant Flow," Nuclear Engineering and Design, Vol 4, No 1, 54-60 (1966).

3. D. Basile, L. Faure and E. Ohlmer, "Experimental Study of the Vibrations of Various Fuel Rod Models in Parallel Flow," Nuclear Engineering and Design, Vol 7, No 6, 517-534 (1968).

4. Y. Takado and T. Egusa, "Vibration of the Fuel Assembly of a Marine Reactor," Nuclear Engineering and Design, Vol 7, No 6, 578-584 (1968).

5. S.S. Chen, "Parallel Flow Induced Vibration of Fuel Rods," Nuclear Engineering and Design, Vol 18, No 2, 253-278 (1972).

6. M.P. Paidoussis, "The Dynamic Behavior of Cylindrical Structures in Axial Flow," Annals of Nuclear Science and Engineering, Vol 1, No 2, 83-106 (1974).

7. Han Liangbi [7281 5328 1732], Shi Guolin [2457 0948 7792], Wang Yufen [3769 3768 5358], Yao Weida [1202 0251 6671], Xu Dinggeng [1776 1353 5105], Cheng Shuxia [4453 2562 7209], He Yuzhi [0149 3768 2655], "Experimental Study of Vibrations of the Fuel Assembly Induced by Water Flow," Problems of Mechanics in Reactor Structure (Collection of Papers on the Conference of Nuclear Reactor Structural Mechanics, 1978), Atomic Energy Press, 349-361 (1979).

8. S. Timoshenko, translated by Wang Yilin [3076 0001 7792], Material Mechanics (Higher Theory and Problems), Science Press, (1979).

9. S. Timoshenko, D.H. Young and W. Weaver, Jr., "Vibration Problems in Engineering," Fourth Edition, John Wiley and Sons, Inc. (1974).

10. Han Liangbi [7281 5328 1732], "Free Vibration of Continuous Beam of Flexible Support of Equal Section," Nuclear Power Engineering, Vol 3, No 1, 71-82 (1982).

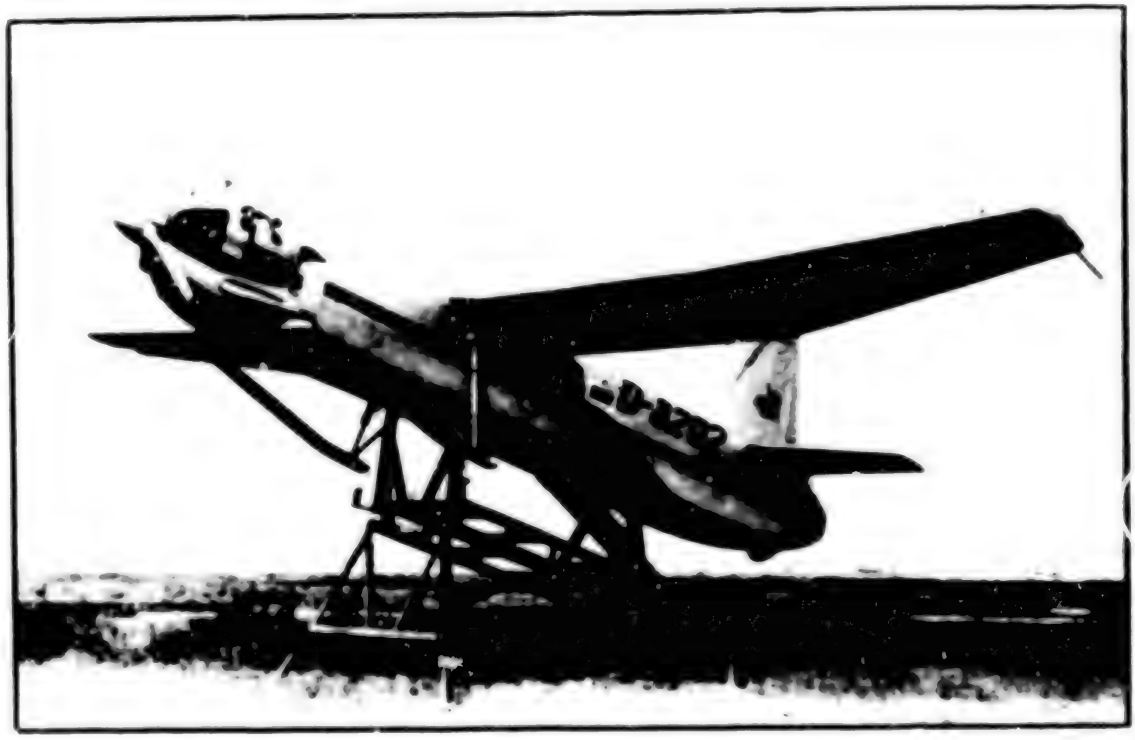
11. Mathematical Handbook, People's Educational Press (1979).

9296
CSO: 4008/95

NORTHWEST ENGINEERING UNIVERSITY DEVELOPS NEW MULTI-PURPOSE RPV

Beijing HANGKONG ZHISHI [AEROSPACE KNOWLEDGE MAGAZINE] in Chinese No 6 Jun 83, inside front cover

[Text] Since October 1982, the Type-D remotely piloted vehicle developed by the Northwest Engineering University has undergone repeated flight tests. Every performance indicator has met the design requirements. This remote pilotless vehicle was designed and developed by the Northwest Engineering University at the behest of the Shaanxi Science and Technology Committee. With some further modification, the aircraft will be able to perform such work as aerial prospecting, water and soil protection, environmental monitoring, photography, and surveys and reconnaissance.



The Type-D Remotely Piloted Vehicle

CSO: 4008/123

STATUS AND DEVELOPMENT OF CHINESE-MADE ULTRASONOGRAPHIC APPARATUS

Beijing YINGYONG SHENGXUE [APPLIED ACOUSTICS] in Chinese, Vol 2, No 1, Jan 83, pp 1-4

[Article by Zhang Qingping [1728 7230 5493] of the Ultrasonographic Laboratory of the Second Subsidiary Hospital of the Wuhan Medical College: "Present and Future of Domestically Manufactured Ultrasonographic Equipment for Diagnosis," received by Magazine on 5 July, 1982]

[Text] I. Historical Retrospect

The B-type ultrasonography was first proposed in the United States at the beginning of the 1950's by Howry and Bliss, and others. In recent years, as electronics and modern medical science have developed, ultrasonographic techniques have made rapid progress. If we take the B-type hand-operated section scanner with a single probe as the first generation, then the quick mechanical scanner and the line-matrix electronic scanner can be regarded as the second generation (real-time images). The line-matrix electron scanner that has electron focusing and short axis focusing and that uses jump scanning, and phase-controlled matrix electron fan-shape scanner are the third generation (real-time images, high resolution). The ultrasonographic section imaging apparatus with a computer processing system is the fourth generation (real-time image, high resolution, rich shades of grey, freeze image, convenient measurement). New types of apparatus are continuing to emerge, and the period of renovation and replacement has shortened. The present new imaging apparatus has generally hastened the speed of imaging, improved the quality of images, and greatly improved the value in clinical application. The pulsed echo imaging technique has reached a more mature stage.

Our nation's first ultrasonographic apparatus was successfully test-manufactured by the First Medical College in Shanghai at the beginning of the 1960s. It combined the B-type and the PPI-type. At the same time, it could produce A-type displays. Therefore it was called the ABP-ultrasonographic apparatus. Not long afterward, Wuhan and Beijing also produced similar types of imaging apparatus which, at the time, served to promote the development of ultrasonic diagnostic techniques in our nation. During the 10 years of upheaval, this new technology, which had been developing, was also devastated. When our nation was in process of

approaching and catching up with foreign levels, it again fell far behind. By the mid 1970's, foreign ultrasonographic technology had reached a fairly high level, such as real time scanning and imaging techniques, the technique of amplitude coding of shades of grey and such new types of apparatus became widely utilized. At this time, our nation's engineers and technicians overcame strong resistance and dangers. In 1975, the Beijing Chaoyang Electronic Instruments Plant test-produced a pseudo-real-time imaging device using rotary mechanical scanning and realized 16 frames (or 24 frames) a second. Because the number of images produced a second was low, flickering occurred. The area of examination was small. Because the cost was high, it was not widely utilized. After the "gang of four" was crushed, the spring in science arrived. The development and production of ultrasonographic apparatus blossomed like a hundred flowers. Various types of new imaging apparatus continued to emerge. We worked to catch up with and surpass advanced foreign levels. In 1976, the Xian 504 Institute successfully manufactured a multiple crystalline chip electronic scanning and line matrix imaging device. The transducer consisted of 20 crystalline chips. The electronic switch caused them to work one after the other to produce straight-line scanned images of 150 frames a second. But the density of the scanning lines was low and the image was not clear enough. Later, Shanghai and Wuhan again successfully test-manufactured the electronic scanning line matrix imaging apparatus with 60 crystalline chips. The Radio Research Institute of Wuhan City developed the XJY-7A-model electronic scanning ultrasonographic discrete layer imaging apparatus in 1979. It used jump scanning and interval scanning techniques to increase line density, and clarity of the image was improved. The Acoustics Institute of the Chinese Academy of Sciences successfully developed the STS-1 model ultrasonographic real-time imaging apparatus in 1981. It used electronic focusing and shades of grey display and improved resolution. The quality of the image produced by the machine reached a higher level and it was transferred to the Shantou Ultrasonic Instruments Research Institute for factory production. The Handan City Medical Equipment Plant in Hebei and the state-run Jiangning Machinery Plant in Wuxi City in Jiangsu Province also test-manufactured similar instruments. In 1978, the mechanical fan-shaped scanner was test-produced by the Mianyang Branch of the Chinese Academy of Sciences, which produced such units as the FJ-784 model mechanical fan-shaped scanning ultrasonographic section imaging apparatus and the GCJ-78 midel ultrasonographic fan-shaped imaging appartus. They have all gone into batch production and are being popularized domestically in clinical practice. The technically more difficult electronic phase-controlled matrix fan-shaped imaging apparatus was begun in 1979 by the Xian Jiaotong University in cooperation with other institutions. In 1981, our nation's first phase-controlled matrix ultrasonographic apparatus, the XKZ-1 model phase-controlled matrix ultrasonographic diagnostic apparatus was created. The major technical properties approached or reached the international level of the mid-1970's. In recent years we have been able to mass-produce components of the transducer for ultrasonographic imaging domestically. In actual use the transducer has worked well. Shanghai also successfully developed the piezoelectric material k_t and k_p parameter-testing device and this improved the speed of testing the crystalline chips of the ultrasonic transducer.

In general, in recent years, all sectors of our nation have emphasized the development and production of ultrasonographic diagnostic apparatus, and development has been very rapid. This fully shows in that in this realm the gap between the technical levels in our nation and foreign nations has visibly been reduced.

II. The Characteristics of Domestically Manufactur . Imaging Apparatus and the Results of Clinical Application

Present imaging appartus, whether imported from abroad or domestically test-manufactured, are all dominated by their high speed scanning real-time imaging appartus. In clinical applications, it can display static structure and also dynamic structure, and the images displayed are not affected by the patient's breathing or the body position. It is easy to operate, the speed of imaging is quick, the scope of application is broad. The various types of high speed scanning real-time imaging apparatus all have definite advantages and shortcomings in their general performance as shown in the table.

Comparative Table of the Various Types of High Speed Scanning Methods

	Mechanical scanning method		Electronic scanning system	
Item	Swaying type	Rotary type	Line matrix	Phase-controlled matrix
Displayed images	Fan-shaped	Fan-shaped, line matrix	Linear	Fan-shaped
Simultaneous B-type and m-type sampling	None	Yes	Yes	Yes
Mechanical smudge	Yes	Yes	None	None
Vibration, noise	Yes	Small	None	None
Weight of transducer	Heavy	Heavy	Heavy	Light
Sonic window needed	Small	Small	Large	Small
Near field	Small	Small	Large	Small
Evenness of scanning lines	Poor	Good	Good	Good
Price	Low	Low	Low	Expensive

Now let us introduce the main characteristics and the results of clinical application of the several types of real-time imaging apparatus that in recent years have gone into test production or are now being sold commercially in the nation.

1. Electronic Line Matrix Real-Time Imaging Apparatus

In recent years, a lot of emphasis has been placed on the devel pment of the line matrix electronic scanner. Efforts are mainly concentrated on improving the quality of the image, improving resolution and making more new attachments such as the image storage, the electronic ruler and the character display. The Wuhan City Radio Research Institute test-developed the image storage as an accessory on the basis of the successful development of the SJY-7A-model electronic scanning ultrasonographic discrete layer imaging apparatus, and used a domestically manufactured large-scale semiconductor as storage and a color television screen as the display. The device can siumltaneously store three B-type section images of different positions and an electrocardiograph within one R-wave cycle, and at the same time store an M-type ultrasonic cardiograph and electrocardiograph. It can also superimpose three setion images of different time phases. As long as a selector switch is turned on, the three images of different positions can be overlapped, and any two can be selected and overlapped. The parts which overlap and those which do not can be differentiated by color. This has a definite value in studying the structure of the heart at different time phases and changes in activity, for example, in studying the abnormality in limited movement of the ventricle wall in the function of the left side of the heart. This apparatus is mainly used to store ultrasonographic images of the heart and the arteries, and it can also be suitably used in storing images of pathological changes in the stomach and intestinal organs in the pelvis cavity, measure the size of the heart, liver, gallbladder, spleen, kidney, and uterus, their pathological nature and their relationship to surrounding organs. The stored images "freeze" on the color television screen for as long as there is no input of new information and the power source is not cut off. This stationary image can aid medical personnel in making detailed observations and it can also facilitate clinical consultation, scientific research photography and teaching. The STS-I-model untrasonographic real-time imaging diagnostic apparatus successfully developed by the Acoustics Institute of the Chinese Academy of Sciences in 1981 absorbed some mature and advanced domestic and foreign techniques. In the electronic circuitry, it used emitted beam electronic scanning and focusing, the large dynamic logarithmic amplifier, an electronic ruler to measure distances, shades of grey display and other such advanced technology. The results of test use of the apparatus showed that the resolution was better: lateral resolution in the focal area (at a depth of 7.5 to 10 cm) was 2mm; at a depth of 5 cm it was 4 mm; the depth of the longitudinal resolution was within 2mm (about 1mm). The sensitivity was high, the displayed images were clear, and when used to observe the internal organs in the abdomen and arteries in deep parts, it could display the images clearly. We could observe the flow of blood in the lower cavity veins. Blood flowed from the feet toward the head. Different ultrasonographic images of many types of pathological changes

could be displayed and they were easy to differentiate. The requirements for clinical application were realized, and the quality of the images could be compared to those produced by similar types of foreign apparatus. But the development of domestic and foreign ultrasonographic imaging apparatus is changing rapidly; we still have a great distance to catch up and we should catch up and be in step with progress.

2. Mechanical Fan-Shaped Scanner

The FJ-784 model ultrasonographic section imaging apparatus and the GCJ-78 (now changed to the CX-model) ultrasonographic fan-shaped imaging apparatus produced by the Mianyang branch academy in Sichuan each have their own characteristics. The FJ-784 model mechanical scanner uses a synchronous electrical motor as a direct drive to enable the step-by-step electric motor swaying under control of the ring distributor large angle even angular speed. A relatively more evenly distributed scanning light grid is produced and the weight of the entire scanner is lighter, weighing only 350 grams. The probe head is assembled in an L-configuration (called the horizontal configuration). This makes it more convenient to capture the target when scanning the human body. The Electronic Instruments Factory subsidiary to the state-run Fujiang Wired Communications Equipment Plant has changed the GCT-78 model instrument to the CX model ultrasonographic imaging apparatus to adapt to different needs, and has differentiated the apparatus into the CX-I model, the CX-II model and the CX-III model. The quality has improved, functions increased, and the configuration of the probe is in many forms. Now, many other regions in the nation, such as Shanghai, Beijing, Wuhan, Xiamen are also developing instruments of this type. This is because the structure is relatively simple, the price is lower than other high speed scanners, and it is suitable for popularization and use. In view of the scope of clinical applications and clinical value, it also has its unique advantages. Because the contact surface required by the probe of the fan-shaped scanner is small and because the structure behind the chestbone can be observed, the sonic window is small and the view is large. It is mainly suited to observing section images of the heart, and it can also display the relationship between the instaneous movement of the heart and the structure of the heart. It has overcome the shortcoming of the M-model ultrasonographic cardigram. It can provide a more direct view in the diagnosis of heart diseases and can display pathological changes as images, for example, in the diagnosis of certain born deformities and internal tumors in the heart. The domestically manufactured mechanicl fan-shaped scanners now being commercially marketed have already met the requirements for clinical use. The image is clearer, but compared to similar foreign instruments, there is still a definite gap. The resolution is poor, the functions are not complete enough, the performance still lacks stability and awaits further improvement.

3. Phase-Controlled Matrix Fan-Shaped Imaging Apparatus

The phase-controlled matrix ultrasonographic diagnostic apparatus is a new type of medical apparatus used clinically during the mid 1970's. The first domestic phase-controlled matrix ultrasonographic diagnostic apparatus was

test-manufactured successfully by the Xian Jiaotong University and like organizations in 1980. The phase control portion of this apparatus uses the method of changing the frequency to control the direction of the beam. The apparatus uses a specific time delay to eliminate the blind area in scanning. This is a unique invention. The phase control receiving circuit uses an 8x8 split-coded control time delay line. The design is successful. The central controller is the controlling and coordinating component of the whole apparatus. This apparatus makes use of hardware to operate. The phase control transducer has 32 units, the frequency is 2.5 MHz. In the short axis direction, an acoustic lens is used for focusing, the largest angle of the fan is 70°, the maximum depth is 16 cm, the number of scanning lines is 128 lines/frame or 256 lines/frame, the frame frequency is 29.37 frames/second. Clinical use by the Second Subsidiary Hospital of the Xian Medical College showed that this apparatus gives a clearer image, it can display the valves of the heart, the separation between the ventricles, the wall of the heart, the heart cavity, the shape of the artery, and it can display motion. It can be used to observe the continuous relationship of the interior structure of the heart, and it can also be used to diagnose pregnancy and certain diseases in the internal organs in the abdomen. Compared to the mechanical fan scanner, the phase-controlled matrix imaging apparatus has a small probe, it is versatile in its uses, it does not produce mechanical vibration, its scanning lines are even and uniform. The modern foreign electronic phase-controlled imaging apparatuses generally have a dynamic electronic focus. They can simultaneously display the M-type image of any position in the B-type image. Every such instrument has a digital scanning converter, rich shades of grey, a freeze frame system and automatic character display of measured data. The quality of the image has reached a relatively high standard, and operation and measurements are very convenient, but such instruments are expensive.

Second, the domestically manufactured hand-operated composite scanners include the CXI-model ultrasonographic apparatus made by the Shanghai Medical and Electrical Instruments Plant. It is equipped with a memory oscilloscope as the image storage. It also has good results in clinical use. The contact type composite scanner can observe a larger area. The complete profile of certain internal organs in the abdomen can be displayed very dense scanning lines can be produced, and the image is very clear. The present high performance omnipotent automatic Octoson imaging apparatus is an outstanding representative of the composite scanner. Its advanced deisgn and technical performance are worth learning.

Foreign nations are developing Doppler imaging apparatus and the new C-model and F-model imaging methods. These are still blanks in our nation. We enthusiastically hope our nation's electronics engineers and technicians, basic researchers in biomedicine and our clinical doctors can cooperate closely and jointly work to develop these new areas.

III. Prospect

Summarizing the above, we see that the series of products of ultrasonographic apparatus developed and now being produced in our nation is becoming more

complete. The application of modern and highly developed electronics engineering technology in ultrasonic medicine will surely stimulate the improvement and perfection of the performance of currently available ultrasonographic apparatus and the emergence of new types of imaging apparatus. The various types of imaging methods currently available will develop toward high performance, high resolution, high clarity, computerization and towards quantity and automation. The quality of the ultrasonographic images is mainly determined by the three factors of resolution, line density and shades of grey of the apparatus. Electronic focusing or electronic dynamic focusing (which can continuously change the focal distance) and the technique of short axis focusing have already been utilized in domestically manufactured imaging apparatus. In scanning circuits, receiving and emitting grouped codes have been utilized, and interval jump scanning and small angle fan-shaped composite scanning methods have been used to increase the scanning line density and the amount of information given by images, and to improve the clarify of the images. Abroad, new modern ultrasonographic apparatus widely use the digital scanning converter or microprocessor for conversion. Rich shades of grey, clear images with less flickering have been obtained. They can automatically display the shades of grey, "freeze the image" and display local magnifications, automatically measure depth and distance and such data, together with other information such as the case number of the patient, the date of examination, the position of the probe, gain, and TGC which are all displayed in characters together with the B-type image on screen. This facilitates the preservation of data and comparison in repeated examination and is very convenient. In future research in domestically manufactured imaging apparatus, we should pay more attention to basic research and the use of new technology, introduce the microprocessor system and signal testing technique to process more inforation and more complex information so that the characteristics of tissue acoustics can be more effectively utilized. It is hoped that more ideal ultrasonographic diagnostic equipment will emerge. In basic research, both domestic and foreign, we hope to come to a clear understanding of the differences in the characteristics of tissue acoustics through quantitative research into the mutual action between ultrasonics and human body tissues, and to provide a reference for quantitative diagnosis. At present, we already know that different acoustic impedance, acoustic absorption and sound velocity. Cancer tissue has a visibly higher acoustic absorption (attenuation) and sound velocity than normal tissues, its characteristics in ultrasonic frequency are also different, and it has a unique spectral line. The ultrasonic absorption of protein is directly proportional to the concentration of protein. The sound velocity in a tissue with a high content of collagen protein is higher than in a tissue with a low content, therefore some people have used the characteristics of the ultrasonic frequency spectrum in the tissue, the attenuation (absorption) characteristics, the sound velocity and the refraction characteristic to explore new ways of ultrasonic diagnosis in the hope of studying a new generation of ultrasonic diagnostic instruments from more ultrasonic parameters and characteristics of tissue acoustics, such as the acoustic impedance graph, sound velocity graph, sound attenuation graph, sound refraction graph and wide-band ultrasonic tissue frequency spectrum characteristics. There are high hopes

for all this work. In general, as ultrasonic engineering technology in biomedicine develops, as these parameters and characteristics are understood in depth and applied, ultrasonic diagnostic techniques will surely make new breakthroughs, and will occupy an important position among X-rays, isotopes and the three major medical diagnostic methods of imaging.

9296
CSO: 4008/47

STUDIES MADE TO EXTEND SERVICE LIFE OF WORKHORSE WJ-6 TURBOPROP ENGINES

Beijing GUOJI HANGKONG [INTERNATIONAL AVIATION] in Chinese No 3, 5 Mar 83, pp 2-4

[Article by Yao Li [1202 0500]: "The Domestically Manufactured Wojiang-6 Engine"]

[Text] The domestically manufactured Wojiang-6 (WJ-6) engine is a medium power high-altitude turboprop engine. Used on the Chinese-built "Yun 8" [Y-8] medium-range transport, it is one of the aviation industry's perfected production line powerplants.

Some of the major technical data of the WJ-6 engine are listed in the accompanying table.

Basic Structure and Its Development

The major components of the WJ-6 engine are: a moderator, transmission mechanism for accessories, air compressor, combustion chamber, turbine, exhause and various types of accessories to guarantee that the engine and the aircraft operate normally.

The moderator is a hermetic differential epicyclic type consisting of a torsion-meter, an automatic sensor of negative pull of the propeller, and an automatic negative pull checking device for the propeller system.

Most accessories of the engine and the aircraft driven by the engine are installed on the accessory transmission box and are driven by the transmission. The inner and outer walls of the accessory transmission box form the intake of the engine.

The air compressor is a subsonic single rotor axial flow type in ten levels. At a specified altitude of 8,000 meters and a velocity of 175 meters/second, the incremental pressure ratio is 9.2. At the fifth and eighth levels are air release valves. The combustion chamber is a mixed type with ten heads. The front part of the flame tube is a structure of linked tubes and the back is a ring structure.

The turbine is a three-level axial response type. The components of the turbine are made of superior quality hig- temperature resistant alloy materials which can guarantee reliability for long periods of engine operation.

Table. Major Technical Data of the WJ-6 Engine

Takeoff	
Equivalent power	4,260 horsepower
Fuel consumption rate	242 grams/horsepower/hour
Rated state	
Equivalent power	3,500 horsepower
Fuel consumption rate	258 grams/horsepower/hour
Highest allow-ble temperature of fuel exhause in rear of turbine	
Degrees (at takeoff)	750°C
Fuel	RP-1, RP-2 or other mixed fuel
Lubricating oil	75% HP-8 and 25% HH-20 (Mixed lubricating oil based on ratio in volume)
Guaranteed life (first rebuilding of engine within warranty period)	1,000 hours

The exhaust consists of an exhause section and a tail cone.

In addition, the WJ-6 engine has more than 20 accessories including a fuel regulator, a startup generator, a governor, a main fuel pump, a main lubricating oil pump, a torsionmeter pump, a de-icer, an ignition and an oil mist separator.

Development

The course of development of the WJ-6 engine can be generally divided into thefollowing five stages:

The design stage:

The prototype trial manufacturing stage;

The initial testing stage. Ten engines were repeatedly tested for more than 3,000 hours. Initial malfunctions that occurred were eliminated and initial test flights of 50 hours were completed on schedule.

The stage of finalization of the designed model. The main work involved finalizing the model engine for trial manufacturing, testing and duration test runs. Then the model of the engine was finalized for test run and test flight.

The stage of followup engineering development. The problems remaining after the design of the WJ-6 engine was completed and finalized were technically solved. The guaranteed useful life before the first rebuilding of the engine reached 1,000 hours. Efforts to prolong the technical life of the engine are being launched in depth. The cumulative operating time of the engine has reached more than 20,000 hours.

Malfunctions Discovered in Tests and Their Elimination

Before the design was finalized, 23 engines were trial produced and many improvement tests were conducted for many prototypes.

During the course of testing the WJ-6 engine, six major malfunctions occurred. The more typical ones were breaking of the conical drum in the engine box of the combustion chamber, cracking of the support, and breaking of the lubricating oil and fuel intake pipes. After related tests and improvements, results in eliminating the malfunctions were visible, and safe and reliable operation of the WJ-6 engine over a long period was realized.

When the three malfuncitons of the engine box of the combustion chamber occurred on the test platform, the engine suddenly caught on fire, smoke was produced and "blasts" occurred. The consumption of lubricating oil increased drastically, the rear exhaust temperature of the turbine of the engine fluctuated (the range of fluctuation was about 20°C). The hermetic pressure in the axial cavity and the middle bearing of the engine rose. At this time, the engine could not operate normally.

To investigate the malfunction, the engine boxes in the combustion chambers of many engines were taken apart and subjected to statistical analysis. The results of the analysis showed that breaking of the conical drum was fairly common, but thelength of the break varied. More important was that this type of breaking was impossible to discover by the naked eye. This showed that the breaking of the conical drum was easily neglected. In addition, statistical results showed that damage to the vertically installed intake oil pipe was more serious than that of a bent intak oil pipe.

In the overall analysis of the reasons for malfunction, inspection of the broek end of the engine box material of the comb ustion end of the engine box material of the combustion chamber showed that the break was related to axial vibration. The broken ends all showed fatigue cracks. The stress of the conical drum was greater than that of the support. This showed that the cracks were caused externally and were unrelated to the material itself. Therefore, the forces acting upon the engine box of the combustion chamber of the engine on the test platform were tested. The test results showed that the breaks were cuased by the overly large amplitude of the fourth harmonic of the propellers and that the pneumatic properties of the test platform were too poor.

Aimed at the cause of malfunction thus discovered, it was decided that a new test platform with good penumatic characteristics--the aircraft wing shaped test platform--would be built. At the same time, it was decided

that a temporary measure would be taken to shorten the propeller blades to make up for the poor pneumatic characteristics of the original test platform. The WJ-6 engine proved in long period tests on the wing shaped test platform that the malfunction of the engine box of the combustion chamber could be entirely eliminated. Tests also proved that the measure of using shortened propeller blades was similarly effective.

In addition, other malfunctions of the WJ-6 engine occurred. For example, the geat of the axle case of the elastic gear broke, the support of the ignition coil broke, cracks in the oil spraying tube of the epicyclic gear occurred. After discovering the causes and taking corresponding measures, good results were obtained in eliminating the malfunctions.

Improvement of Performance

In the course of development, the low power of the WJ-6 engine, the high comsumption of lubricating oil, the high exhause temeprature of the turbine, the longer time required for takeoff on plateaus were improved, and visible technical results were realized.

Low power. This was mainly related to the improper match between the air compressor and the turbine. The following two measures were taken:

1. In improving the air compressor, partial welding and affixing of the stator blade were changed to welding the entire stator blade in the socket for the blade to reduce secondary loss of reflux on the surface at the end of the back of the blade and the small blade, increase the high pressure air flow in the air compressor, improve the velocity of flow of the exit flow field, and improve efficiency, thus increasing the power of the shaft.

2. In improving the turbine, the area of the first level guide was reduced to increase the velocity of air flow, and the area of the second level guide and the area of the third level turbine and guide were also increased respectively to improve takeoff from the ground surface, specified in-flight performance and thus increase the power of the entire turbine.

Because the above measures were taken, the power originally lost was recovered and theproblem of low power was solved.

Large consumption of lubricating oil. Because the sealed gaps of the engine were too large and the functional gap between the throttle switch of the fuel regulator and the casing was improper, the amount of lubricating oil that scattered in the air and that mixed in with the fuel and burned away increased. After corresponding measures of improvement, the consumption of lubricating oil visibly dropped to below the designed index.

High rear exhaust temperature of the turbine. After conducting tests of more than ten engines, we understood clearly the characteristics of the rear temperature field of the turbine. Ground tests and in-flight use showed that under true temperatures (referring to the horizontal field temperature of the temperature field of 300 temperature measuring points and the temperature

of the highest temperature point), the engine could operate normally. Afterwards, the angle of installation of the rectifying blade of the air compressor was appropriately adjusted. This improved the rear temperature field of the turbine so that the measured temperature visibly dropped. After this improvement and adjustment, actual outdoor use of more than 2,000 hours showed that the rear exhaust temperature of the turbine completely coincided with the requirements of technical indices.

The long takeoff period required on plateaus. After separately improving and adjusting the ignition and the rectifier blade of the air compressor, the engine showed a visibly shortened time of startup on the test platform. Use in plateau regions showed that after the WJ-6 engine was left for 15 to 40 hours, it successfully started up immediately under low temperatures.

Ground Test and Test Flight

During the course of development of the WJ-6 engine, partial and whole tests were widely conducted, for example, tests of the characteristics of the whole air compressor unit and fatigue test of the air compressor blades, tests of the performance of the combustion chamber and high altitude ignition tests, tests of excess rotation of the turbine disk and hot impact tests of the turbine blade, twisiting fatigue test of the elastic axle, low cycle fatigue test of the entire engine, excess rotation and excess temperature tests, etc. At the same time, various types of special tests were conducted on the engine. The purpose of the tests was to guarantee safety and reliability in outdoor use. In addition, some projects beyond the regulations for outdoor use were conducted to test emergency handling under special situations. There are some other tests that are being actively arranged and organized.

The WJ-6 engine operated in 30 takeoffs and landings according to the 50-hour preliminary test flight plan on the basis of the success of preliminary tests. In-flight tests showed that the operation of the engine was stable.

After finalizing the design (up to now, the cumulative number of lengthy ground surface test runs reached more than 7,000 hours), the WJ-6 engine entered its final design test flight. With the cooperation of concerned units, the engine was tested in-flight in extremely cold regions, under extremely high temperatures, and in plateau regions. The installed WJ-6 engine flew over 15 provinces (cities, regions), east to Jiangsu, west to Xizang, south to Guangzhou, north to Heilongjiang, and it was tested in-flight over a large area. During the period of test flights, malfunctions that could not be remedied in-flight did not occur. After completing the test flights, the engine was analyzed and inspected. They showed that the spare parts and components of the WJ-6 engine were all in good condition.

The work of prolonging the technical life of the WJ-6 engine is gaining new progress. Ground tests and outdoor use are continuing. The development of the model of the WJ-6 engine with more power and a modified model for multiple use on aircraft are also being accelerated.

9296
CSO: 4008/83

BRIEFS

LASER DEVELOPMENTS--Beijing, 4 Jun (XINHUA)--Lasers have been used on a trial basis in the treatment of animal diseases in most of China's provinces, municipalities and autonomous regions, according to a recent national meeting on laser application. The Beijing Agricultural Institute and veterinary scientists in Inner Mongolia Region have developed a carbon dioxide laser medical instrument which is effective for 93 percent of sheep suffering from diarrhea. Each year, a million of lambs die of diarrhea in Inner Mongolia alone, one of China's major pastoral regions. Hebei, Liaoning and Shaanxi Provinces and Beijing have experimented with laser technology to cure inactive ovary of animals. Experiments conducted by the Hebei Agricultural Institute indicates that 80 percent of 200 cows and mares which were sterile because of diseases resumed fertile ability after seven days of treatment. Laser surgery has been applied in castrating pigs and excising pituitary body. In some fowl breeding, the hatching period has been shortened after laser treatment, according to the meeting. [Text] [OW040312 Beijing XINHUA in English 0254 GMT 4 Jun 83 OW]

MUDFLOW OBSERVATION CENTER--Beijing, 2 Jun (XINHUA)--China's first mudflow observation center built with modern equipment last year, has successfully forecasted five occurrences of the mudflow in the past few months, thus avoiding great losses of life and property, according to the Chinese Academy of Sciences here today. The center in Dong Chuan of Yunnan Province, affiliated to the Chengdu Institute of Geography, is installed with equipment to record precipitation, mudflow dynamics, and power measurement as well as taking mudflow sampling and analysis. China has a high occurrence of mudflows which often happens on barren steep slopes and are generated by heavy rainfall. The rushing down of mud and rocks at great speed can cause great damage to life and property. The establishment of the center will provide theoretical basis for the study of the mudflow's formation, mechanical features and anti-mudflow measures. [Text] [Beijing XINHUA in English 0806 GMT 2 Jun 83 OW]

ELECTRON POSITRON COLLIDER--Beijing, 5 Jun (XINHUA)--The Chinese Academy of Science will build a 2 x 2.2 gev electron positron collider in the western suburb of Beijing. The collider is to be built at the high energy

accelerator research center of the academy's High Energy Physics Institute. So far, the scientists of the institute have completed the physical designing, and are undertaking the prefabrication research on key equipment of the collider and the preliminary designing of the project. The whole project will be completed in 1988. The academy said that the construction of the collider aims at promoting China's high energy research and experiment, which will provide synchrotron radiations such as vacuum ultraviolet and hard x-ray source. The completion of the project will play an important role in the country's theoretical and experimental research of basic particles and the application of synchrotron radiations. In addition, the High Energy Physics Institute will expand its 10 mev proton linear accelerator, which went into operation last year, into a 35 mev proton linear accelerator. [Text] [OW060429 Beijing XINHUA in English 0204 GMT 5 Jun 83]

AUTHOR: XUE Pan [1331 3961]

ORG: None

TITLE: "Joint Work Conference Held by Electronic Computer Society China Society of Electronics and China Society of Chinese-language Information Research"

SOURCE: Beijing JISUANJI XUEBAO [CHINESE JOURNAL OF COMPUTERS] in Chinese No 3, 1983 p 221

ABSTRACT: The Preparation Group of the conference to be held in Yantai in Dec 83 is composed of LI Juchang [2621 5112 2490] of the Organization Committee of E. Computer Society, MEN Suqin [7024 4790 3830] of Zhejiang Provincial Computer Society, ZHENG Yulin [6774 3768 2651] of Shandong Provincial Society of Electronics Computer Specialty Committee, and representatives of the Office of China Society of Chinese Language Information Research. The conference was divided into 2 periods. The first period will be devoted to the study and discussion of ways to improve the quality and the effect of the society continuously. Full-time and part-time workers of the field and all other scientists and technicians are welcome to write papers on the subject. The second period will deal with individual projects.

6168
CSO: 4009/175

AUTHOR: None

ORG: None

TITLE: "Fourth Annual Conference of Society of Vaccum Electronics Specialty Held in Shanghai"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 2, Mar 83 p 8

ABSTRACT: The Fourth Annual Conference of Vacuum Electronics Specialty Society China Society of Electronics was held in Shanghai on 9-15 Dec 82 and attended by more than 240 delegates. The conference was chaired by HU Minzhai [5170 2404 7872]; the opening speech was delivered by LIU Shenggang [0491 4141 4854]. Aside from 10 papers presented before the entire delegation, the conference was divided into the 3 groups of general theory and superhigh frequency, electron beam, and materials and work processes for discussing the remaining 120 papers. These papers were acknowledged to have the following characteristics: (1) A close connection with international development has been established and computers have been used for designing all electron vacuum and photoelectronic devices; (2) The development of millimeter wave and submillimeter wave electron vacuum devices has been stressed and trends of development of other solid-state devices, etc.have begun to be studied; (3) Modern surface analysis techniques have been adopted to study work procedures; (4) Research on and for improving introduced techniques and equipment has begun; (5) Attention has been given to linking theory and practice. It was resolved that the Fifth Annual Conference will be held in Xianyang in 1984.

AUTHOR: None

ORG: None

TITLE: "Symposium on the Application of Digital Technology in Broadcasting and Television Held in Tianjin"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 2, Mar 83 p 39

ABSTRACT: A symposium on the Application of Digital Technology in Broadcasting and Television, organized by the Broadcasting Television Specialty Society China Society of Electronics, was held in Tianjin on 6-10 Jan 83 and attended by 80 delegates. It was chaired by Senior Engineer SUI Jingyi [9536 4842 5030]. Associate Prof. YU Sile [0205 2448 2867] introduced his impression of the 9th International Broadcasting Conference. Senior Engineer GUAN Zhiji [1351 4249 4634] reported on his observation of foreign conditions of development of video disks. Through democratic discussion and appraisal, papers on time-cosine transform encoding of color television signals, PAL system compound signal sampling forecast encoding, resolution test card-DPCM encoding of analogous video images, the sound track system of television broadcasting, and noise control of PAL color television signals were chosen to be the superior ones.

AUTHOR: None

ORG: None

TITLE: "Report of the Spring Symposium on New Ways of Developing Integrated Circuits and Computer Industry"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 2, Mar 83 pp 72, 15

ABSTRACT: Under the auspices of China Society of Electronics,a symposium was held on 19 Jan 83 and attended by members of the board of directors of the society, leaders of the electronic industry, and specialists of the science of electronics to discuss the development of computer and integrated circuitry before the year 2000 so as to contribute to the goal of doubling the annual production of China's national economy. Many opinions and strategies were presented, including the following: (1) The backward condition of "each going its own way" must be changed to establish a unified command system with authority to coordinate research, production, teaching, sales, and service so that manpower, financial power, and materials may be organically combined to deal with the development of the various links in the chain from components to a complete computer; (2) The current situation of "eating out of the big pot" management of the computer industry must be changed to raise the use value potential of the machines; (3) The attitude of stressing development but not service must not be allowed to continue; (4) Such policy problems as government subsidy to protect the computer industry from competition, the benefit of investors, harmonizing such modern technology as computers with socioeconomic development of China; (5) Researches on and extension of electronic materials, electron sensitive components, and other electronic products must be further stressed.

6248
CSO: 4009/165

AUTHOR: None

ORG: None

TITLE: "The ϕ Type 5 m Vertical Shaft Windmill Generator Group Certified"

SOURCE: Beijing QINGHUA DAXUE XUEBAO [JOURNAL OF TSINGHUA UNIVERSITY] in Chinese No 1, 1983 p 38

ABSTRACT: With the cooperation of Beijing Research Institute of Reinforced Plastics, the Department of Thermal Energy Engineering of the university and the Institute of Electrical Engineering of the Academy of Sciences have successfully made the ϕ type 5 m vertical shaft windmill generator group, which underwent the certification process in Beijing on 25-27 Oct 82. The Department of Thermal Energy Engineering accepted the research project commissioned by the Science and Technology Division of Ministry of Hydroelectricity in Mar 78. A wind power experiment site was established in Badaling in Oct 80. The machine of the windmill was made by its Baoding Base and the blades [or vanes] were made with the cooperation of Beijing Research Institute of Reinforced Plastics. The Institute of Electrical Engineering Chinese Academy of Sciences installed the silicon rectifier self-excited electrical machinery. The windmill generator group has been test operated 2 winters and springs, under conditions of wind storm and low temperature, for an accumulated operating time of 500 hours. Related departments believe it to be very suitable for communication stations, microwave stations, television broadcasting stations, and isolated areas of rich wind resources to provide power for communication, pumping water, and other aspects of daily living. Surveys and researches are being conducted to extend its application as soon as possible.

AUTHOR: None

ORG: None

TITLE: "Technique of Extracting Gold and Silver"

SOURCE: Beijing QINGHUA DAXUE XUEBAO [JOURNAL OF TSINGHUA UNIVERSITY] in Chinese No 1, 1983 p 48

ABSTRACT: The technique of extracting gold and silver, a product of successful research of the Department of Chemical Engineering of the university underwent technical certification in Beijing on 17 Nov 82. Compared with work processes of the past, the recovery rate of silver is 4-5 percent higher and the rate of recovery of gold is 1-2 percent higher. The new process is also simpler, the production cycle shorter, and the work condition better. Specialists believe this technique will provide experiences for extracting and purifying other precious metals and will also have important significance in promoting gold and silver production in China.

AUTHOR: None

ORG: None

TITLE: "New Type of'Calorimeter' Successfully Made"

SOURCE: Beijing QINGHUA DAXUE XUEBAO [JOURNAL OF TSINGHUA UNIVERSITY] in Chinese No 1, 1983 p 60

ABSTRACT: The Department of Automation of the university had successfully produced the technique of measuring the quantity of heat of hot water and on the foundation of this technique, the department and Shanghai Dahua Meter Plant jointly designed the 'calorimeter', which was officially named by the Ministry of Machine Industry the NRS-01 hot water heat quantity indicating, cumulative calculation meter. Continuous operation of more than 5000 hours at the central heating systems of the new boiler room of the university, the Beijing Municipal Thermal Power Company, etc. has proved the meter to be stable and reliable and some of its major indices to have reached or surpassed the level of similar foreign products. This research project was commissioned by State's Bureau of Materials and Beijing Municipal Office of Coal Conservation. The meter is primarily used to establish a quantitative relationship between the heat supply department and the customer so that the current unreasonable system of charging fees on the basis of the floor space of a building may be abolished. It may also be used to monitor the operating condition of hot water boilers, testing residual heat utilization equipment, various heat exchangers, solar energy hot water apparatus, and geothermal water to provide a scientific basis for raising equipment heat efficiency, for conserving energy, and for developing new energy sources.

AUTHOR: None

ORG: None

TITLE: "The FB-1 β Backscatter Plating Layer Thickness Gage Successfully Produced"

SOURCE: Beijing QINGHUA DAXUE XUEBAO [JOURNAL OF TSINGHUA UNIVERSITY] in Chinese No 1, 1983 p 72

ABSTRACT: The Nuclear Electronics Teaching and Research Group of the Department of Engineering Physics of the university, the 1915 Institute of Ministry of Electronic Industry, and the Nuclear Energy Institute of Chinese Academy of Sciences have produced, through joint research, the FB-1 β backscatter plating layer thickness gage. It was certified in Beijing on 27 Nov 82. Test application of the gage at actual production lines in 774 Plant, 200 Plant, 699 Plant, and 708 Plant in Beijing has proved the gage to be obviously effective in improving the work process and controlling the quality of products. The Certification Conference acknowledged it to be the first successful small area β plating layer thickness gage made in China. Its technical indices meet the β thickness measurement standard regulated by the State and have reached the level of similar products made in foreign countries in the middle 70's. The successful production of the gage is very significant in improving the surface plating layer of electronic components, printed circuits, etc. as well as in saving such precious metals as gold. Its price is only half of similar products made in foreign countries. It is being manufactured by the 261 Plant and orders are being accepted by that plant.

6248
CSO: 4009/167

AUTHOR: HUANG Tianhua [7806 1131 5478]
FAN Yaoshan [5400 5069 1472]
CHEN Linan [7115 4539 3948]
LI Pu [2621 3877]
MIAO Yansheng [5379 1693 3932]
LI Changchun [2621 7022 2504]

ORG: HUANG, FAN, CHEN, LI of Medical Genetics Research Office, MIAO, LI of Department of Urology of Hospital No 1, Harbin University of Medicine

TITLE: "Effect of Gossypol Acetate on the Function of rRNA Gene and Acrocentric Chromosome Association in Human Cells"

SOURCE: Beijing ZHONGHUA YIXUE ZAZHI [NATIONAL MEDICAL JOURNAL OF CHINA] in Chinese No 2, Feb 83 pp 97-100

ABSTRACT: Gossypol acetate is the male contraceptive first clinically tried in China. For the purpose of studying its effect on human rRNA function or whether dangers of increased trisomic syndrome caused by increased frequency of acrocentric chromosome association and of easy occurrence of ectopic pregnancy exist a study was conducted with improved silver staining technique on 11 healthy men of 30-48 months of continuous oral administration of gossypol acetate. A group of 11 healthy men with no history of taking the drug formed the control. No statistically significant difference of distributions of Ag-NOR and Ag-AA between the two groups was found. Details of the study are reported. This paper was received for publication on 11 Apr 82.

6248
CSO: 4009/161

AUTHOR: HUA Jiashou [5363 1367 1108]

ORG: None

TITLE: "Report of National Axial Parts Symposium"

SOURCE: Shanghai JIXIE ZHIZAO [MACHINERY] in Chinese No 3, 1983 p 45

ABSTRACT: A National Symposium of Axial Parts was held on 20-26 Dec 82 in Guangze County, Fujian Province and attended by representatives of colleges, special schools, research institutes, designing departments, and plants. The symposium was divided into groups for the delivery of 32 papers while 54 papers were exchanged by the entire delegation. Contents of the papers involved methods of design calculation, property research, and experimentation of axial parts. Research results in the development of new theories and new technologies and the design of new types of axial parts were introduced. For example, the traditional method of calculating the strength of axial parts is based upon the strength of the materials yet strength condition equations are related to safety coefficients for which homogeneity of materials must be considered; therefore, to a very large extent subjective experience is used to determine many variable factors. Application of computers and optimal designing has made it possible to obtain precise and optimal design parameters of axial parts. In recent years, with the rapid development of elastic hydrodynamic lubrication theory (EHL), many scientists have become very interested in using this theory to resolve design calculation problems of gears and axes to improve their properties, to save energy, and to reduce cost.

6248
CSO: 4009/157

AUTHOR: None

ORG: None

TITLE: "Third Annual Conference of China Society of Mechanical Engineering Machine Processing Society"

SOURCE: Guangzhou JICHUANG YU YEYA [MACHINE TOOL AND HYDRAULICS] in Chinese No 2, 1983 p 68

ABSTRACT: The Third Annual Conference of China Society of Mechanical Engineering Machine Processing Society was held in Zhengzhou City on 24-27 Nov 82. The Board of Directors reported on its work. The Secretary of the Society, ZHANG Kechang [1728 0344 2490] introduced the condition of the 82rd CIRP Annual Conference. The conference was then divided into 4 special subject groups of cutting and measurement, machine tool, grinding, and production system for the delivery of the papers. Judging from the papers presented at the conference, (1) Researches on cutting and grinding processes have emphasized experimentation and production application; (2) The realm of designing basic parts of machine tools using computer and finite element method has been further broadened; (3) Attention is given to uniting theoretical research with production practice; (4) Application of digital control technology, for example microcomputers, in machine tools has begun; (5) Research and application of assembly technology have been practiced in some enterprises and have attracted the attention of many departments.

AUTHOR: LIANG Baoti [2733 0202 1029]

ORG: None

TITLE: "National Standards Examination Conference"

SOURCE: Guangzhou JICHUANG YU YEYA [MACHINE TOOL AND HYDRAULICS] in Chinese No 2, 1983 p 70

ABSTRACT: National Standards Examination Conference to review the 2 items of 'grading of grains of solid pollutants of hydraulic work medium' and 'determination of structural completeness of hydraulic filter core' was held in Guangzhou on 11 Dec 82. The conference was chaired by the representative of the Secretariat of the National Hydraulics and Pneumatics Standardization Technology Committee and attended by more than 20 delegates of 18 units of the country. Delegates of 1st Academy of Ministry of Spaceflight and Guangzhou Research Institute of Machine Tools read the respective draft standards and introduced in detail the processes of their formulation before the conference proceeded to review and discuss the contents, the style, and the accuracy of terms and phrases for the purpose of proposing revisions. These 2 draft standards were formulated on the basis of adopting the international standards (ISO). Through comparison and analysis, the delegates discussed the 2 items in accordance with the ISO standards and the concrete conditions in China. The delegates unanimously passed the 2 drafts which will be readied for final approval and enactment.

6248
CSO: 4009/173

AUTHOR: QIU Zhongquan [6726 0022 5425]

ORG: None

TITLE: "Certification Conference for the SWB-1 NC Wattless Automatic Compensator"

SOURCE: Zhuzhou SHUKONG JISHU TONGXUN [COMMUNICATION ON NC TECHNIQUE] in Chinese No 2, 1983 p 35

ABSTRACT: The SWB-1 Numerical Control Wattless Automatic Compensator is a product of joint research by Zhuzhou Electric Locomotive Plant of Ministry of Railways and Zhuzhou Radio Plant No 8. Its certification conference, chaired by Zhuzhou Municipal Science Committee, was held in Zhuzhou on 26 Mar 83 and attended by 60 delegates of academies, colleges, and plants all over the country. Under the condition of load variation, the compensator can automatically engage or cut off capacitors of different groups to cause the power factor to be stably controlled at above 0.95. It can also continuously operate for a long period of time without an attendant. The compensator is composed of MOS integrated circuits and has a numerical display for the power factor. Major technical indices of the compensator are briefly introduced in the paper.

AUTHOR: NAN Jin [0589 6855]

ORG: None

TITLE: "Certification of the NCL-1 NC Experiment System"

SOURCE: Zhuzhou SHUKONG JISHU TONGXUN [COMMUNICATION ON NC TECHNIQUE] in Chinese No 2, 1983 p 45

ABSTRACT: Nanjing School of Machine Manufacture has succeeded in making the NCL-1 Numerical Control Experiment System. Its technical certification conference was held in Nanjing on 28-30 Dec 82. At the request of Ministry of Machine Industry, Jiangsu Provinical Department of Machine Industry organized the conference which was attended by 30 delegates representing 21 units. The delegates agreed that the system is reasonably designed and its concept, layout, and form of linkage are innovative. The entire system is in a modular form and has relatively high interference resistance. It can meet the needs of teaching courses of NC control technology and can also be valuable for production and research departments. The delegates proposed that after the quality of its components and assembly is improved , voltage protection measure added, and related documentation perfected, it may be produced in batches.

AUTHOR: ZHU Ke [2612 4430]

ORG: None

TITLE: "Microcomputer Controlled Electroplating Automated Line Appraisal Meeting"

SOURCE: Zhuzhou SHUKONG JISHU TONGXUN [COMMUNICATION ON NC TECHNIQUE] in Chinese No 2, 1983 p 48

ABSTRACT: Zhuzhou Electrical Locomotive Plant succeeded in producing the microcomputer controlled electroplating automated line. Since it was officially in operation in Jul 82 it has been running reliably for more than 8 months. A technical appraisal meeting was called by Zhuzhou Municipal Science Committee on 28 Mar and participated in by leaders, scientists, technicians, and workers representing colleges, research institutes and plants. The delegates listened to the chief designer LIU Jianhan [0491 1696 3352] reporting the research and designing process of the automated line and explaining the reason for choosing the microcomputer control scheme. The delegates observed and carefully investigated the condition of operation and production of the automated line. They examined the microcomputer, the connecting circuits, the execution apparatus, and the mechanical parts. The unit using the line reported the condition and effects of operation of the line. Finally, the delegates unanimously agreed that the condition for the line's technical certification has been met and suggested its approval by the supervising agency. The delegates especially commended the extension and application of microcomputer and regarded it to be a very valuable job.

6248
CSO: 4009/169

AUTHOR: SUN Jinwen [1327 6855 2429]

ORG: None

TITLE: "National Symposium on Nonlinear Mechanics Held in Wuxi"

SOURCE: Wuhan GUTI LIXUE XUEBAO [ACTA MECHANICA SOLIDA SINICA] in Chinese No 1, Mar 83 p 119

ABSTRACT: Initiated by Prof. QIAN Weichang [6929 0251 7022], the Theorectical Mechanics and Mathematical Method in Mechanics Specialty Group of China Society of Mechanics called a National Symposium on Nonlinear Mechanics in Wuxi, on 18-22 Oct 82. A total of 85 delegates of 50 units of schools of higher education, research institutes, and the national defense system attended the symposium. Prof. QIAN delivered a report on "Nonlinear Mechanics." Contents of the 72 papers exchanged involved fluids, turbulent flow, shock wave, isolated wave, fracture, vibration, stability, elasticity, elastic dynamics, atmosphere, celestial bodies, earth, the application of the singular perturbation theory, and the newest basic theories and experimental researches. The participants proposed unanimously that (1) An international nonlinear mechanics symposium should be organized and held in 1985; (2) Special subject symposium should be called in 1983 to discuss divergence, sudden change, and stability; (3) A symposium on singular perturbation theory should be held in Shanghai during the summer of 1983.

AUTHOR: YI Lin [1837 2651]

ORG: None

TITLE: "A Spring Symposium Called by China Research Society of Chinese Character Information"

SOURCE: Beijing JISUANJI YANJIU YU FAZHAN [COMPUTER RESEARCH AND DEVELOPMENT] in Chinese No 4, Apr 83 p 62

ABSTRACT: Using modernized means of processing information in the Chinese language mode is a new complex scientific technology, connecting many scientfic fields of computer technology, written and spoken linguistics, psychology, logic, etc. At present, the most important problem to be resolved is the technique of processing Han-character information. The fruits of research on this subject will have inestimable effects on all countries and regions where Han characters are being used, involving more than 10 percent of the world's population. This symposium, held on 3 Mar 83, was attended by 100 specialists. Current problems in developing the Han-character information processing system, the condition and prospect of natural language processing, input encoding of Han characters, and the compilation of dictionaries used in Han-character information processing, etc. were extensively discussed. It was announced that 30 Han-character information processing systems and terminals will be exhibited at the International Symposium of Chinese-language Information Processing to be held in Oct 83.

6248

CSO: 4009/164

END

END OF FICHE DATE FILMED

July 1st 1983